ATLAS is one of the two main experiments at the Large Hadron Collider (LHC) investigating the microscopic properties of matter to address the most fundamental questions of particle physics. Major upgrades are planned to increase the LHC's luminosity, which will give rise to the High Luminosity Large Hadron Collider (HL-LHC) with peak luminosity increased by a factor of 3.75 beyond today's values. To fully exploit the discovery potential offered by HL-LHC, the ATLAS detector will need a completely new Inner Tracking system (ITk). During the modernization foreseen to end by 2026, a completely new tracker made of silicon devices - a mixture of Pixel and Strip layers - will replace the present inner detector. The new ITk will have finer granularity and better coverage in pseudorapidity to cope with the high particle density and the intense radiation environment at the HL-LHC.

The proposed thesis aims to develop the micro-strip system for ITk, which will fully exploit the physics potential at the HL-LHC. In the coming year, ITk will enter the production phase. The detector modules will be integrated into more extensive subsystems, commissioned, and tested. The first part of the research for the proposed thesis will include an evaluation of the performance of the new micro-strip detector for physics research. The measured performance will be compared with simulation studies regarding the ITk track parameter resolution and the forward tracking extension.

The HL-LHC will be the so-called Higgs factory, meaning that there will be over 100 million Higgs bosons in 3000 inversed femtobarns collected at the end of data taking. It is expected that in this data volume, the Higgs boson production associated with W and Z bosons, or vector boson fusion (VBF), will be observed. For the overall Higgs precision measurement program, the improved b-tagging performance, improved tagging of pile-up jets and improved τ and photon identification will also benefit many channels, particularly VBF,$H \rightarrow WW^*$ production. The Higgs production associated with W and Z bosons is an essential process for precision measurements of the Higgs boson couplings to vector bosons within the Standard Model (SM) and indirect searches for the new physics phenomena beyond SM.

Therefore, the proposed Ph.D. thesis will study measurement and the discovery potential for the VBF,$H \rightarrow WW^*$ process on the HL-LHC in the context of the new ITk detector's performance and the corresponding measures done in the course of the next season of the LHC data taking.